Science News

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Dr. Matt Bobrowsky
matt@msb-science.com
http://www.linkedin.com/in/mattbobrowsky

Life Science

Teasing apart the effects of mutations on "fitness"

A new study may help explain why sex and genetic recombination are advantageous. It turns out that the effect of one gene is dependent on the presence of one or more other genes. Where this dependence doesn't exist, genetic selection acts on different mutations independently, so that each additional mutation would cause the same decline in relative fitness. By contrast, if synergistic effects of multiple, harmful mutations are occurring, each additional mutation could cause a larger decrease in relative fitness. Scientists analyzed full genomes of humans from three established datasets in Europe, and the genomes of Zambian fruit flies from another dataset. They computed the mutation effects, focusing on rare groups of genes for coding different types of mutations, and compared these mutations to "essential" genomes of the two species. Based on the distribution of mutations across both genomes, the researchers conclude that selection in humans and flies is indeed synergistic; that is, an individual's decline in fitness increases with each additional mutation compared to the decrease in fitness if each mutation were acting alone. The mixing of genes that occurs during sexual reproduction is important for reducing the negative effects of mutations.
https://www.sciencedaily.com/releases/2017/05/170504161453.htm

Earth Science

Hawaii: How the world's biggest volcanoes formed

A recent study has solved the 168-year-old mystery of how the world's biggest and most active volcanoes formed in Hawaii. The study found that the volcanoes formed along twin tracks due to a shift in the Pacific Plate's direction three million years ago.* Heat from the Earth's core causes hot columns of rock, called mantle plumes, to rise under tectonic plates and produce volcanic activity on the surface. Twin volcanic tracks emerged because the mantle plume was out of alignment with the direction of the plate

motion. Plate shifts have been occurring constantly, but irregularly, throughout Earth's history. Looking further back in time it appears that double tracks are not unique to young Hawaiian volcanism — indeed, they coincide with other past changes in plate motion. Hawaii sits at the south-eastern limit of a chain of volcanoes and submerged seamounts which get progressively older towards the northwest.
https://www.sciencedaily.com/releases/2017/05/170503131933.htm

*For technical details, see the original research paper in Nature.
http://www.nature.com/nature/journal/vaop/ncurrent/full/nature22054.html

Climate Change

Decades of data on world's oceans reveal a troubling oxygen decline

A new analysis of decades of data on oceans across the globe has revealed that the amount of dissolved oxygen contained in the water — an important measure of ocean health — has been declining for more than 20 years. Researchers found that oxygen levels started dropping in the 1980s as ocean temperatures began to climb. And now the rate of global oxygen loss appears to be exceeding the level of nature's random variability. Falling oxygen levels in water have the potential to impact the habitat of marine organisms worldwide, and in recent years, led to more frequent "hypoxic events" that killed or displaced populations of fish, crabs, and many other organisms. Researchers have for years anticipated that rising water temperatures would affect the amount of oxygen in the oceans, since warmer water is capable of holding less dissolved gas than colder water. But the data showed that ocean oxygen was falling more rapidly than the corresponding rise in water temperature. This is most likely due to the changes in ocean circulation and mixing associated with the heating of the near-surface waters and melting of polar ice.
https://www.sciencedaily.com/releases/2017/05/170504104346.htm

Physical Science and Technology

The world's fastest film camera

[Have your metric prefix chart handy.]
Researchers have developed a camera that can film at a rate equivalent to five trillion images per second, or events as short as 0.2 trillionths of a second. This is faster than has previously been possible. The new super-fast film camera will be able to capture incredibly rapid processes in chemistry,

physics, biology, and biomedicine, that so far have not been caught on film. To illustrate the technology, the researchers have successfully filmed how light — a collection of photons — travels a distance corresponding to the thickness of a paper. In reality, it only takes a picosecond, but on film the process has been slowed down by a trillion times. Currently, high-speed cameras capture images one by one in a sequence. The new technology is based on an innovative algorithm, and instead captures several coded images in one picture. It then sorts them into a video sequence afterwards. In short, the method involves exposing what you are filming (for example a chemical reaction) to light in the form of laser flashes where each light pulse is given a unique code. The object reflects the light flashes, which merge into the single photograph. They are subsequently separated using an encryption key. The film camera is initially intended to be used by researchers who literally want to gain better insight into many of the extremely rapid processes that occur in nature. Many take place on a picosecond and femtosecond scale, which is unbelievably fast — the number of femtoseconds in one second is significantly larger than the number of seconds in a person's life-time. Some of the super-fast processes that could be filmed include explosions, plasma flashes, turbulent combustion, brain activity in animals, and chemical reactions.
https://www.sciencedaily.com/releases/2017/04/170428093839.htm

Astronomy

Nearby star is a good model of our early solar system

Scientists have confirmed that a nearby star's planetary system contains separate belts of asteroids, similar to our own solar system. The star is also about one-fifth the age of our sun. All that makes this star a good model of the early days of our solar system. The star is called epsilon Eridani, and is located about 10 light-years away from the sun. This star hosts a planetary system currently undergoing the same cataclysmic processes that happened to our solar system in its youth, at the time in which the moon gained most of its craters, Earth acquired the water in its oceans, and the conditions favorable for life on our planet were set.
https://www.sciencedaily.com/releases/2017/05/170502141953.htm

Science & Society

New research shows illegal levels of arsenic found in baby foods

In the European Union (EU), almost half of baby rice food products contain illegal levels of inorganic arsenic despite new regulations. In January 2016, the EU imposed a maximum limit of inorganic arsenic on manufacturers in a bid to mitigate associated health risks. Researchers have found that little has changed since this law was passed and that 50% of baby rice food products still contain an illegal level of inorganic arsenic. Babies are particularly vulnerable to the damaging effects of arsenic that can prevent the healthy development of a baby's growth, IQ, and immune system. Rice has, typically, ten times more inorganic arsenic than other foods. The research findings compared the level of arsenic in urine samples among infants who were breast-fed or formula-fed before and after weaning. A higher concentration of arsenic was found in formula-fed infants, particularly among those who were fed non-dairy formulas, which includes rice-fortified formulas favored for infants with dietary requirements such as wheat or dairy intolerance. The weaning process further increased infants' exposure to arsenic, with babies five times more exposed to arsenic after the weaning process, highlighting the clear link between rice-based baby products and exposure to arsenic. A simple process of percolating rice could remove up to 85 per cent of the arsenic. So far many manufacturers have not been taking this helpful step.
https://www.sciencedaily.com/releases/2017/05/170504161538.htm

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